

Appln No. 10/665,304
Amdt date July 20, 2007
Reply to Office action of February 21, 2007

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Please amend claims 1 and 25 and add claims 50-56 as follows:

1. (Currently Amended) A method of manufacturing a cutting element comprising:
selecting an ultra hard material having a volume and which is not fully densified;
selecting a substrate having a volume, wherein at least a portion of said substrate
[[which]] has a density that is less than 100% of full density of said at least a portion;
placing the ultra hard material over the substrate; and
sintering the resulting assembly of substrate and ultra-hard material at a sufficient temperature and pressure for full densification and metallurgical joining of the substrate and ultra hard material, wherein the ultra hard material shrinks during sintering, and wherein the density is selected in response to the volumes of said substrate and said ultra hard material for providing a desired level of constraint by the substrate to the ultra hard material shrinkage during sintering.
2. (Previously Presented) A method as recited in claim 1 wherein a first portion of the substrate has said density and a second portion of the substrate is fully densified prior to sintering.
3. (Previously Presented) A method as recited in claim 2 wherein said substrate first portion extends over the second portion and wherein the ultra hard material layer is placed over the first portion.
4. (Cancelled)

5. (Previously Presented) A method as recited in claim 1 wherein selecting a substrate comprises selecting a substrate comprising an outer portion surrounding an inner portion, wherein the outer portion of the substrate has a density less than 100% of full density of said outer portion and the inner portion of the substrate is fully densified.

6. (Previously Presented) A method as recited in claim 1 wherein selecting a substrate comprises selecting a substrate wherein a first portion of the substrate has a first density and wherein a second portion of the substrate has a second density, wherein the first density is different from the second density.

7. (Previously Presented) A method as recited in claim 1 wherein selecting a substrate comprises selecting a substrate wherein the entire substrate has a density less than 100% of full density of the substrate.

8. (Previously Presented) A method as recited in claim 1 wherein selecting a substrate comprises selecting a substrate wherein said at least a portion has a density in the range of about 70% to about 90% of full density of said portion.

9. (Previously Presented) A method as recited in claim 1 wherein selecting a substrate comprises selecting a substrate wherein said at least a portion has a density in the range of about 40% to about 99% of full density of said portion.

10. (Previously Presented) A method as recited in claim 9 wherein selecting a substrate comprises selecting a substrate wherein said at least a portion has a density in the range of about 75% to about 99% of full density of said portion.

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11. (Previously Presented) A method as recited in claim 1 wherein selecting a substrate comprises selecting a substrate wherein the substrate prior to sintering has a porosity of in the range of about 1% to about 30%.

12. (Original) A method as recited in claim 1 further comprising forming a non-uniform face on the substrate material, wherein the ultra hard material is placed over the non-uniform face.

13-24. (Cancelled)

25. (Currently Amended) A method of manufacturing a cutting element comprising:
selecting an ultra hard material which is not fully densified;
selecting a pre-sintered substrate having a first portion that has a first density less than 100% of full density, and a second portion that has a second density that is different from the first density;
placing the ultra hard material over the substrate; and
processing the resulting assembly of substrate and ultra hard material at a sufficient temperature and pressure for full densification and metallurgical joining of the substrate and ultra hard material, wherein the ultra hard material shrinks during sintering, and wherein the densities of the two portions are selected for providing a desired level of constraint by the substrate to the ultra hard material shrinkage during sintering.

26. (Original) A method as recited in claim 25 wherein the first density is in the range of about 70% to about 90% of full density.

27. (Original) A method as recited in claim 25 wherein the first density is in the range of about 40% to about 99% of full density.

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28. (Previously Presented) A method as recited in claim 27 wherein the first density is in the range of about 75% to about 99% of full density.

29. (Original) A method as recited in claim 25 wherein the first density is in the range of about 40% to about 70% of full density.

30. (Original) A method as recited in claim 25 wherein the substrate prior to sintering has a porosity of in the range of about 1% to about 30%.

31. (Original) A method as recited in claim 25 further comprising forming a non-uniform face on the substrate material, wherein the ultra hard material is placed over the non-uniform face.

32. (Previously Presented) A method as recited in claim 25 wherein the second density is 100% of full density.

33. (Original) A method as recited in claim 25 wherein first and second densities are selected for controlling the magnitude of the residual stresses generated on the ultra hard material layer during sintering.

34. (Previously Presented) A method as recited in claim 1 wherein the density is selected to minimize the constraint provided by the substrate to the ultra hard material shrinkage during sintering.

35. (Previously Presented) A method as recited in claim 1 wherein the substrate and the ultra hard material shrink during sintering and wherein the density is selected to minimize shrinkage difference between the substrate and the ultra hard material during sintering.

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36. (Previously Presented) A method as recited in claim 1 wherein the ultra hard material comprises diamond.

37. (Previously Presented) A method as recited in claim 25 wherein the densities are selected to minimize the constraint provided by the substrate to the ultra hard material during sintering.

38. (Previously Presented) A method as recited in claim 25 wherein the substrate and the ultra hard material shrink during sintering and wherein the densities are selected to minimize shrinkage difference between the substrate and the ultra hard material during sintering.

39. (Previously Presented) A method as recited in claim 25 wherein the ultra hard material comprises diamond.

40-49. (Cancelled).

50. (New) A method as recited in claim 1 wherein the substrate is pre-sintered.

51. (New) A method as recited in claim 25 wherein the substrate has a volume and wherein the ultra hard material layer has a volume and wherein the densities of the two portions are selected in response to the volume of said substrate and the volume of said ultra hard material layer.

52. (New) A method of manufacturing a cutting element comprising:
selecting an ultra hard material having a volume and which is not fully densified;

selecting a substrate having a volume, a first portion that has a first density less than 100% of full density, and a second portion that has a second density that is different from the first density;

placing the ultra hard material over the substrate; and

processing the resulting assembly of substrate and ultra hard material at a sufficient temperature and pressure for full densification and metallurgical joining of the substrate and ultra hard material, wherein the ultra hard material shrinks during sintering, and wherein the densities of the two portions are selected in response to the volume of the substrate and the volume of the ultra hard material for providing a desired level of constraint by the substrate to the ultra hard material shrinkage during sintering.

53. (New) A method of manufacturing a cutting element comprising:
selecting an ultra hard material solid having a volume;
selecting a substrate having a volume, wherein at least a portion of said substrate has a density that is less than 100% of full density of said at least a portion;
placing the ultra hard material solid over the substrate; and
sintering the resulting assembly of substrate and ultra-hard material solid at a sufficient temperature and pressure for full densification of the substrate and joining of ultra hard material solid to the substrate, wherein the density is selected in response to the volumes of said substrate and said ultra hard material solid for providing a desired level of constraint by the substrate to the ultra hard material solid during sintering.

54. (New) The method as recited in claim 53 wherein the ultra hard material solid is porous.

55. (New) A method of manufacturing a cutting element comprising:
selecting an ultra hard material solid;

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selecting a pre-sintered substrate, wherein at least a portion of said substrate has a density that is less than 100% of full density of said at least a portion;

placing the ultra hard material solid over the substrate; and

sintering the resulting assembly of substrate and ultra-hard material solid at a sufficient temperature and pressure for full densification of the substrate and joining of ultra hard material solid to the substrate, wherein the density is selected for providing a desired level of constraint by the substrate to the ultra hard material solid during sintering.

56. (New) The method as recited in claim 55 wherein the ultra hard material solid is porous.